

Application No.: 10/526,936
Reply to Office Action of: October 5, 2007

BASIS FOR THE AMENDMENT

New Claims 5-14 have been added as supported by the specification as originally filed.

No new matter is believed to have been added by entry of this amendment. Entry and favorable reconsideration are respectfully requested.

Upon entry of this amendment Claims 1-14 will now be active in this application.

REMARKS

Applicants respectfully request reconsideration of the application, as amended, in view of the following remarks.

It is an object of the present invention to provide a process for the preparation of polyisobutenes having a high content of terminal vinylidene double bonds, in which lower molecular weights are obtained with a given relative amount of complex catalyst or the amount of catalyst can be reduced to obtain a given molecular weight. Furthermore, the obtained polyisobutenes should have a narrow molecular weight distribution. See page 2, lines 26-32 of the specification.

The present invention as set forth in **Claim 1** relates to a process for the preparation of polyisobutene comprising at least 75 mol% of terminal vinylidene groups, wherein isobutene or an isobutene-containing hydrocarbon mixture is polymerized in a liquid phase in the presence of a boron trifluoride complex catalyst having a composition



wherein

Co1 is at least one tertiary alcohol,

Co2 is at least one compound selected from the group consisting of water, primary alcohols, secondary alcohols, dialkyl ethers, alkanecarboxylic acids and phenols,

the ratio c:b is from 0.9 to 1.8 and

the ratio (b+c):a is from 0.9 to 3.0.

Tokumoto et al fail to disclose or suggest a process as claimed using a catalyst as claimed.

Applicants wish to thank Examiner Bullock for the helpful and courteous discussions with Applicants' Representative on December 19, 2007 and December 20, 2007. During this

discussion it was noted that the catalyst used in Tokumoto et al. (EP 1026175A1) is substantially different from the claimed catalyst (see for example equations 1 and 2 at page 3 of EP '175). The present invention requires the presence of a tertiary alcohol and a second component, as well as a ratio c:b of 0.9 to 1.8 and a ratio of (b+c):a of 0.9 to 3.0. Upon further review of the reference the Examiner agreed that the claimed ratios are outside the range of EP'175).

The catalyst of EP'175 is substantially different from the catalyst in the claimed process. Firstly, the catalyst of EP'175 is an ether-type complex catalyst, wherein the major portion of the donor molecules are aprotic ether molecules and only a minor part are protic molecules, namely water and/or alcohol. This is clear from equation 1 which requires that the ratio of ether to alcohol and/or water exceeds 2:33 ($X > 0.3$ – see page 3, line 11 and also line 43. In contrast thereto, the catalyst of the present invention contains only protic donor molecules and is thus an alcohol-type catalyst.

Secondly, the catalyst of EP'175 requires another ratio of the two types of donor molecules than the catalyst according to the present invention. Assuming that the tert.-butanol molecule in the catalyst according to present claim 1 has a similar function as the ether molecule in the catalysts of EP'175, it must be noted that in the catalyst of EP'175 the ratio of alcohol/water to ether is < 1:2.33 to 1:199 while in the catalyst according to present claim 1, the ratio of component c (corresponding to alcohol and/or water) to tert.-butanol (corresponding to ether) is in the ratio from 0.9 to 1.8 and thus clearly outside the range given in EP'175.

Consequently, the catalyst of EP'175 is substantially distinct from the catalyst in the claimed process.

EP'175 neither motivates a person of ordinary skill in the art to replace the ether by tert.-butanol nor does it provide motivation to deviate from the ratio of the donor molecules

given in equation 1 of EP'175. Firstly, the inventors of EP'175 point to the importance of combining ether and a protic donor molecule, namely alcohol and/or water (see par. 0022 on page 3). Therefore, they refer to their catalyst as ether/alcoholtype co-complex in order to distinguish them from the ether-type complexes and alcohol-type complexes. Although, EP'175 mentions that alcohol-type complexes might work under specific circumstances, it is also mentioned that this catalyst-type causes problems as the content of residual fluorine increases. Therefore, a person of ordinary skill in the art would not have been motivated to replace the ether by an alcohol. In this context, it must be noted that the inventors of the present invention found out that it is not possible to obtain a stable course of the polymerization reaction when ter.-butanol is used as the only donor molecule in the complex catalyst (see example 4 in table on page 7).

Secondly, a person of ordinary skill in the art would not have been motivated to deviate from the ratio of the two different donor molecules as given by equation 1 of EP'175. In paragraph [0037] it is pointed to the importance that the amount of protic molecules in the complex catalyst is low, since otherwise the amount of residual organic fluorine would increase. Therefore, a person of ordinary skill in the art would not have been motivated to use a complex catalyst, wherein the relative amount of protic donor molecules to other donor molecules exceeds 0.3:0.7.

Further, Applicants would like to point to the results presented in the table on page 7 of the specification. As pointed out in the introductory part of the present application, it is an object of the present invention to reduce the amount of boron trifluoride necessary to produce a low molecular weight polyisobutene. It is common knowledge that lower molecular weights are generally achieved by using larger amounts of catalysts and vice versa (see page 2, 4th paragraph. This object was surprisingly achieved by using a complex catalyst of boron trifluoride comprising tert.-butanol and a second donor molecule. As can be seen from

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examples 1 to 3, the use of methanol, ethanol or isopropanol as donor molecules leads to relatively high molecular weights, while the use of tert.-butanol alone does not lead to a stable polymerization reaction. In contrast thereto, the combined use of tert.-butanol and a second protic donor molecule leads to markedly lower molecular weights with same amounts of boron trifluoride. This is an important advantage in the production of polyisobutenes since it is clear that the amount of boron trifluoride can be reduced for a given molecular weight to be produced.

Therefore, the rejection of Claims 1-4 under 35 U.S.C. § 103(a) over Tokumoto et al is believed to be unsustainable as the present invention is neither anticipated nor obvious and withdrawal of this rejection is respectfully requested.

This application presents allowable subject matter, and the Examiner is kindly requested to pass it to issue. Should the Examiner have any questions regarding the claims or otherwise wish to discuss this case, he is kindly invited to contact Applicants' below-signed representative, who would be happy to provide any assistance deemed necessary in speeding this application to allowance.

Respectfully submitted,

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